TOBT80"02058260

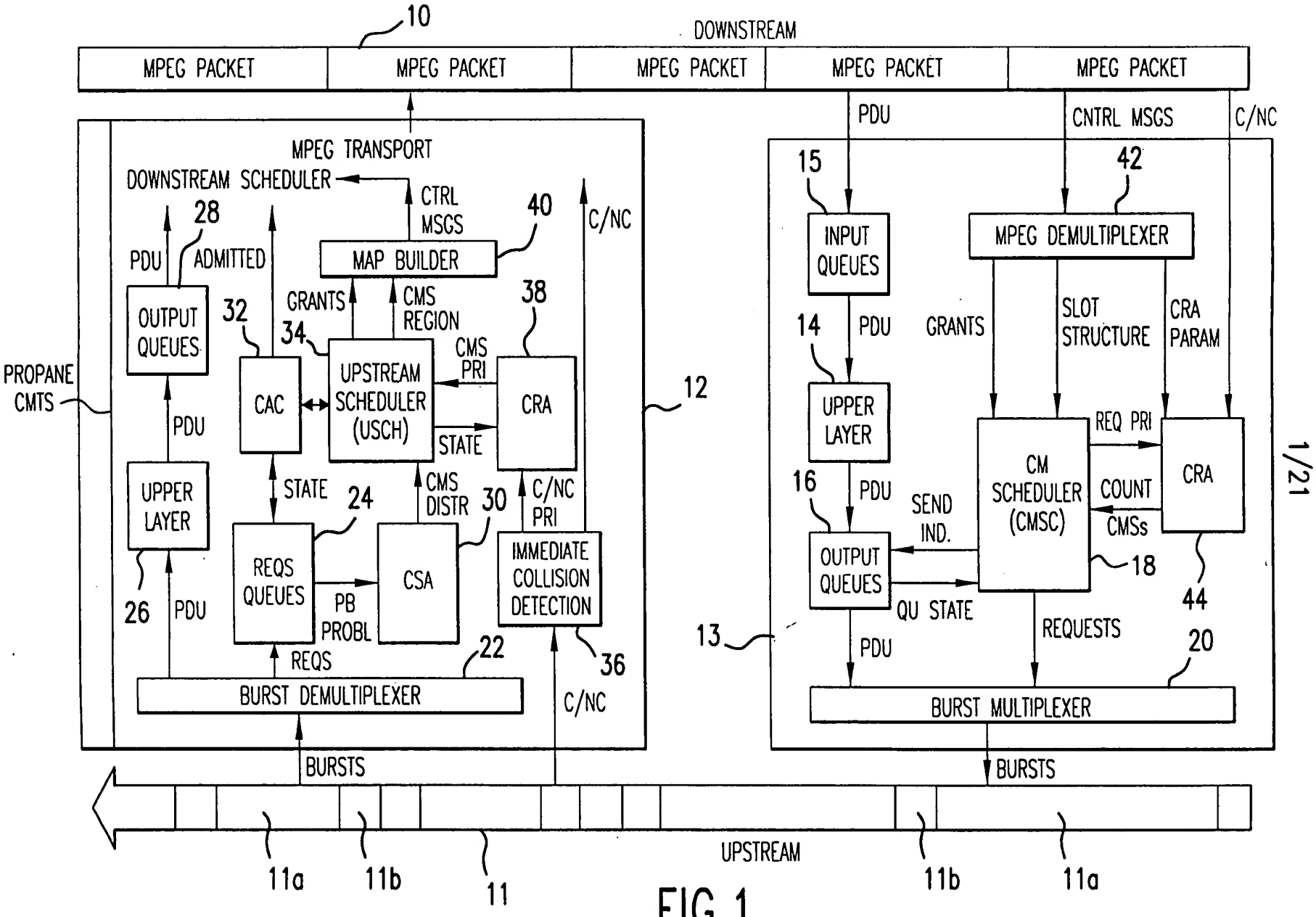
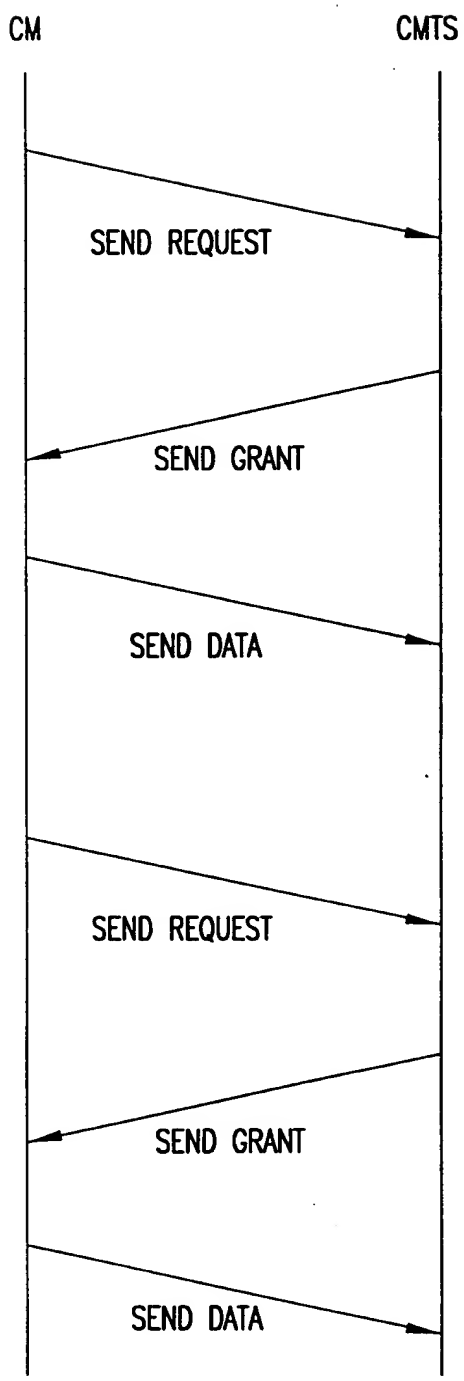
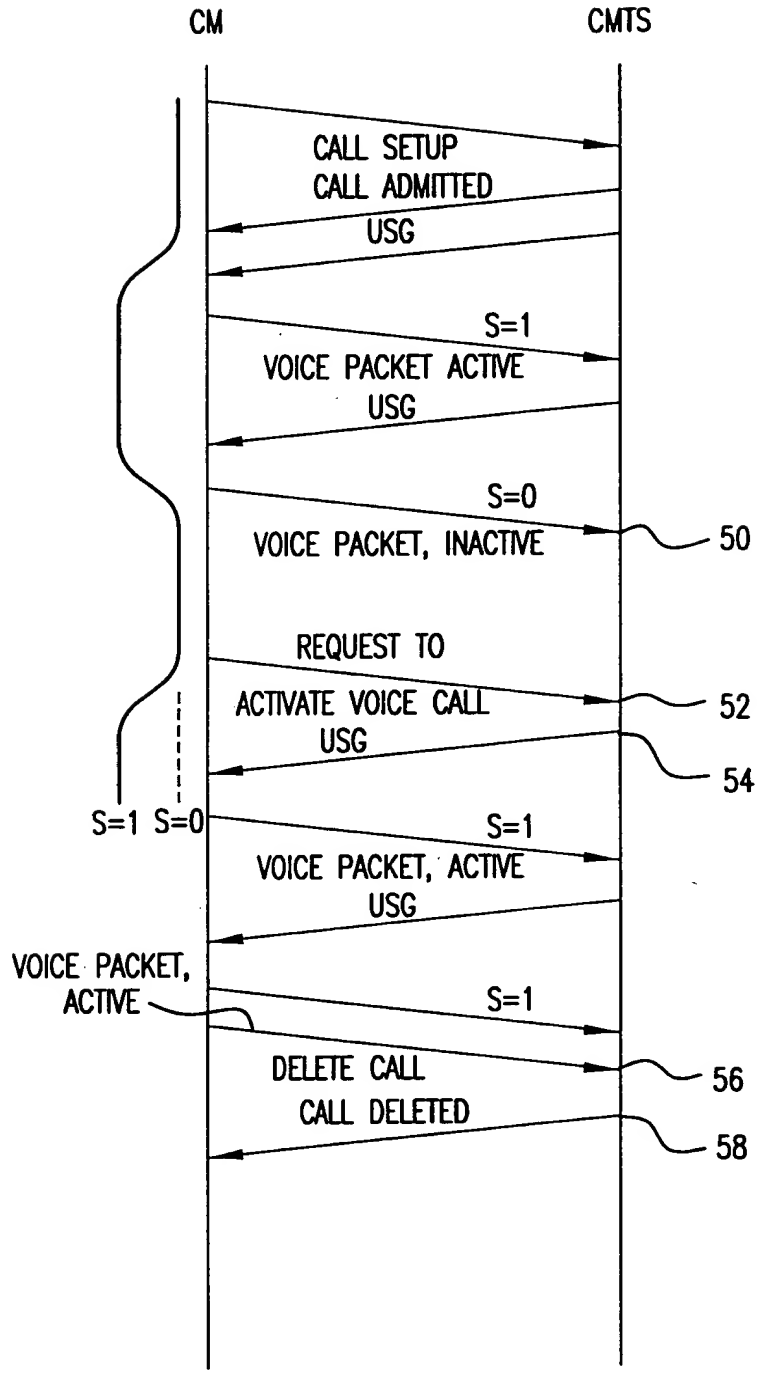


FIG.1



DATA SERVICE

FIG.2A



VOICE SERVICE

FIG.2B

EP 0 581 818 B1

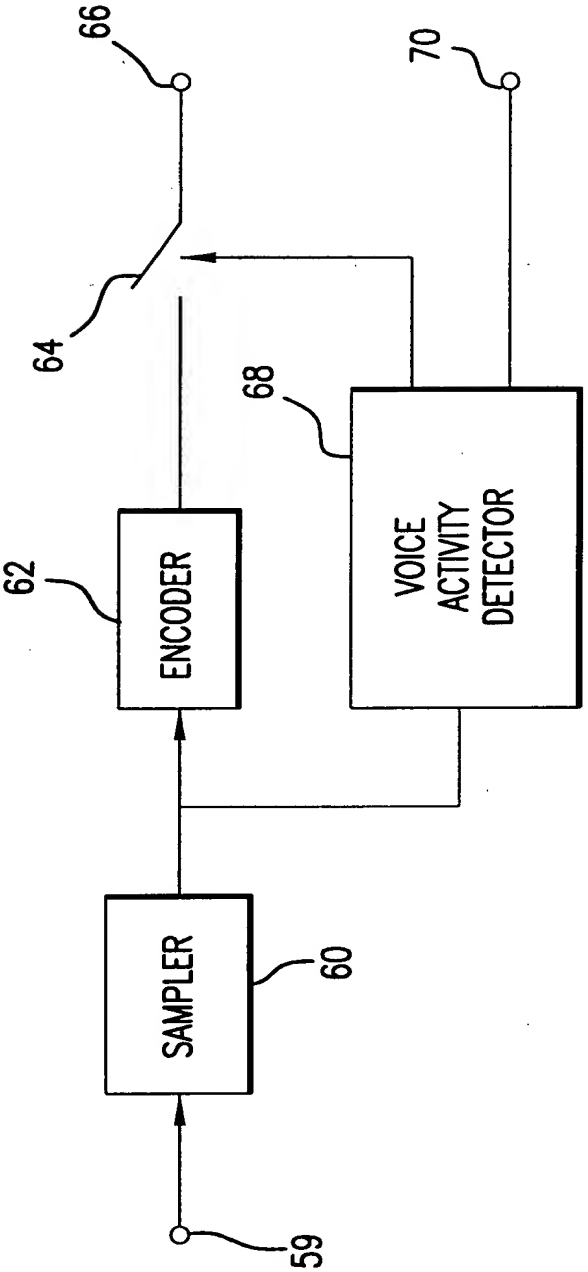


FIG.3

FIG.4A

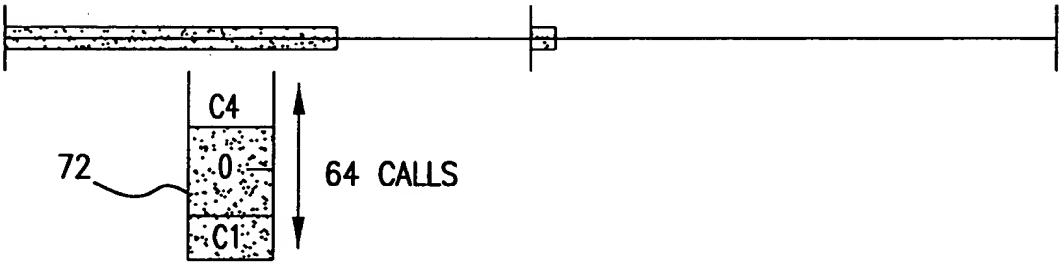


FIG.4B

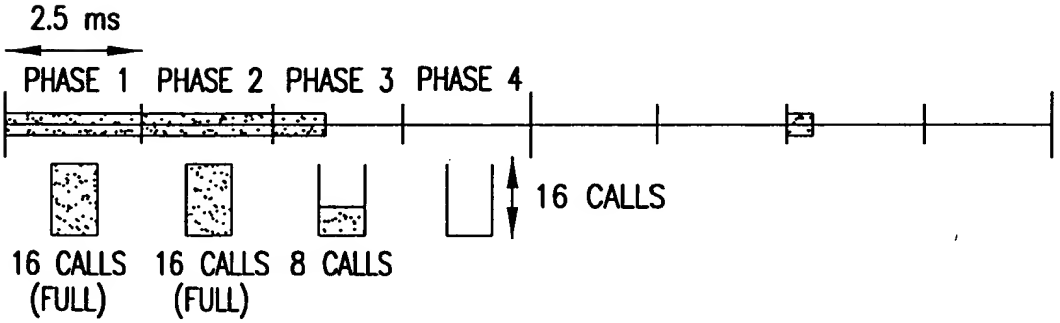


FIG.4C

FIG.4D

EP 0 851 698 A2

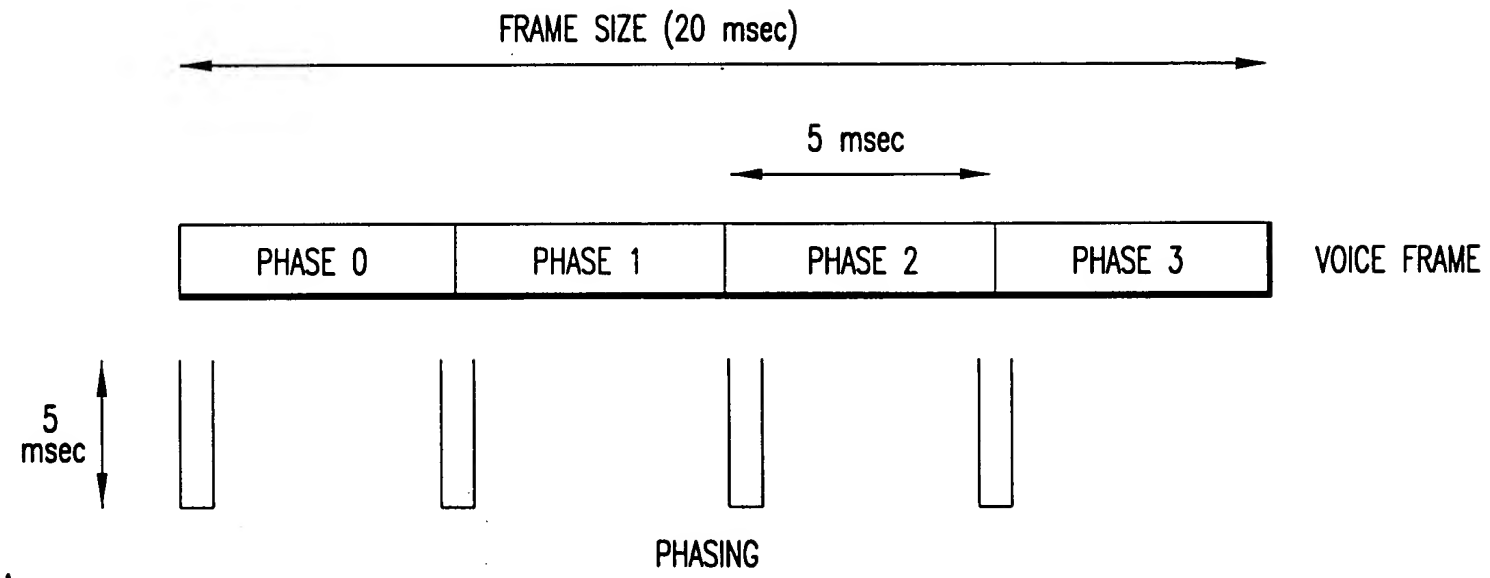

FRAME SIZE (20 msec)
5 msec
PHASE 0
PHASE 1
PHASE 2
PHASE 3
VOICE FRAME
5
msec
PHASING

FIG.5A

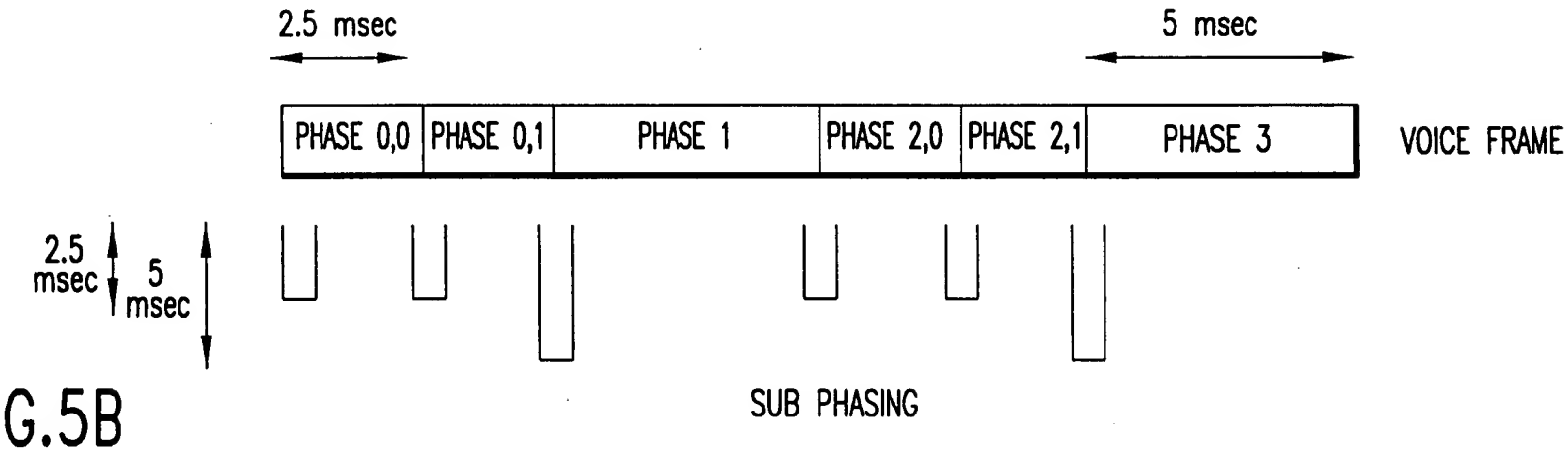
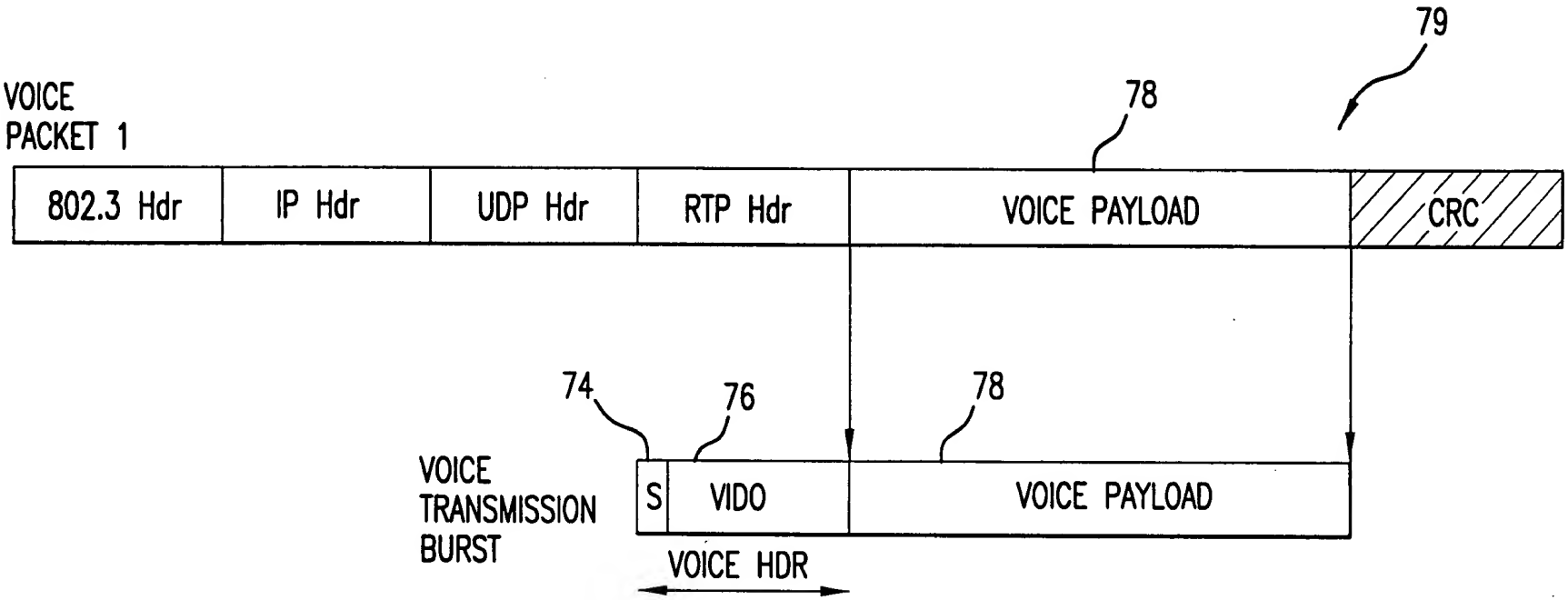

2.5 msec
5 msec
PHASE 0,0
PHASE 0,1
PHASE 1
PHASE 2,0
PHASE 2,1
PHASE 3
VOICE FRAME
2.5
msec
5
msec
SUB PHASING

FIG.5B

CALL 1: CM1, VIDO: 5ms, 16 Kbps=2 MS (1:0)
CALL 2: CM2, VIDO: 10ms, 32 Kbps=4 MS (2:0)
CALL 3: CM3, VIDO: 20ms, 32 Kbps=7 MS (3:0)
CALL 4: CM4, VIDO: 20ms, 32 Kbps=7 MS (4:0)
CALL 5: CM1, VID1: 10ms, 16 Kbps=3 MS (1:1)
CALL 6: CM2, VID1: 10ms, 16 Kbps=3 MS (2:1)

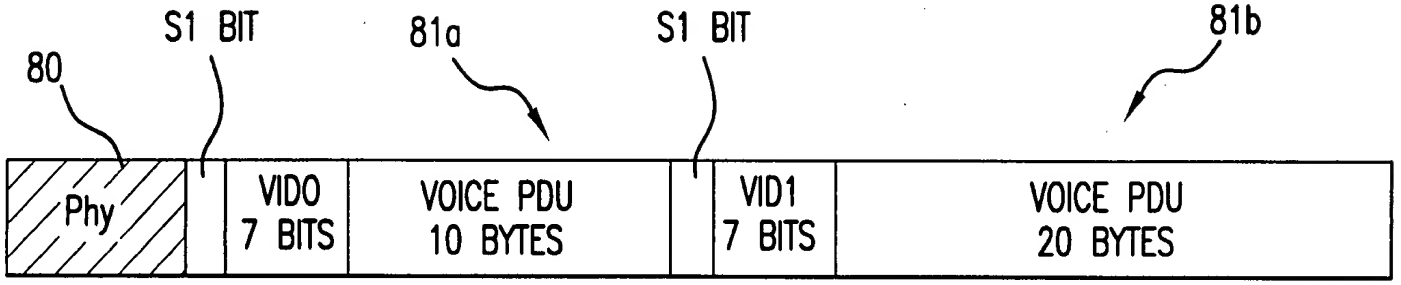
FIG.5C

EP 0 961 520 A2 09 12 1999



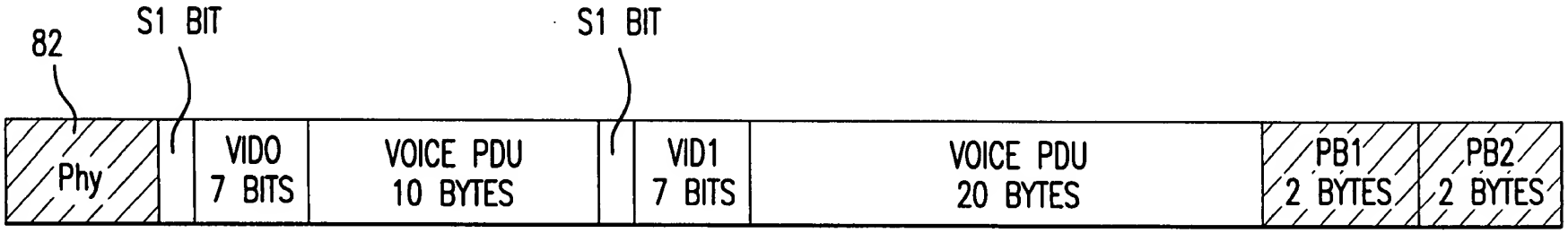
MAPPING VoIP PACKETS INTO VOICE PDUs

FIG.6A



CONCATENATION OF TWO VOICE CHANNELS OF DIFFERENT RATES

FIG.6B



CONCATENATION OF VOICE CHANNELS AND PIGGYBACKING REQUESTS

FIG.6C

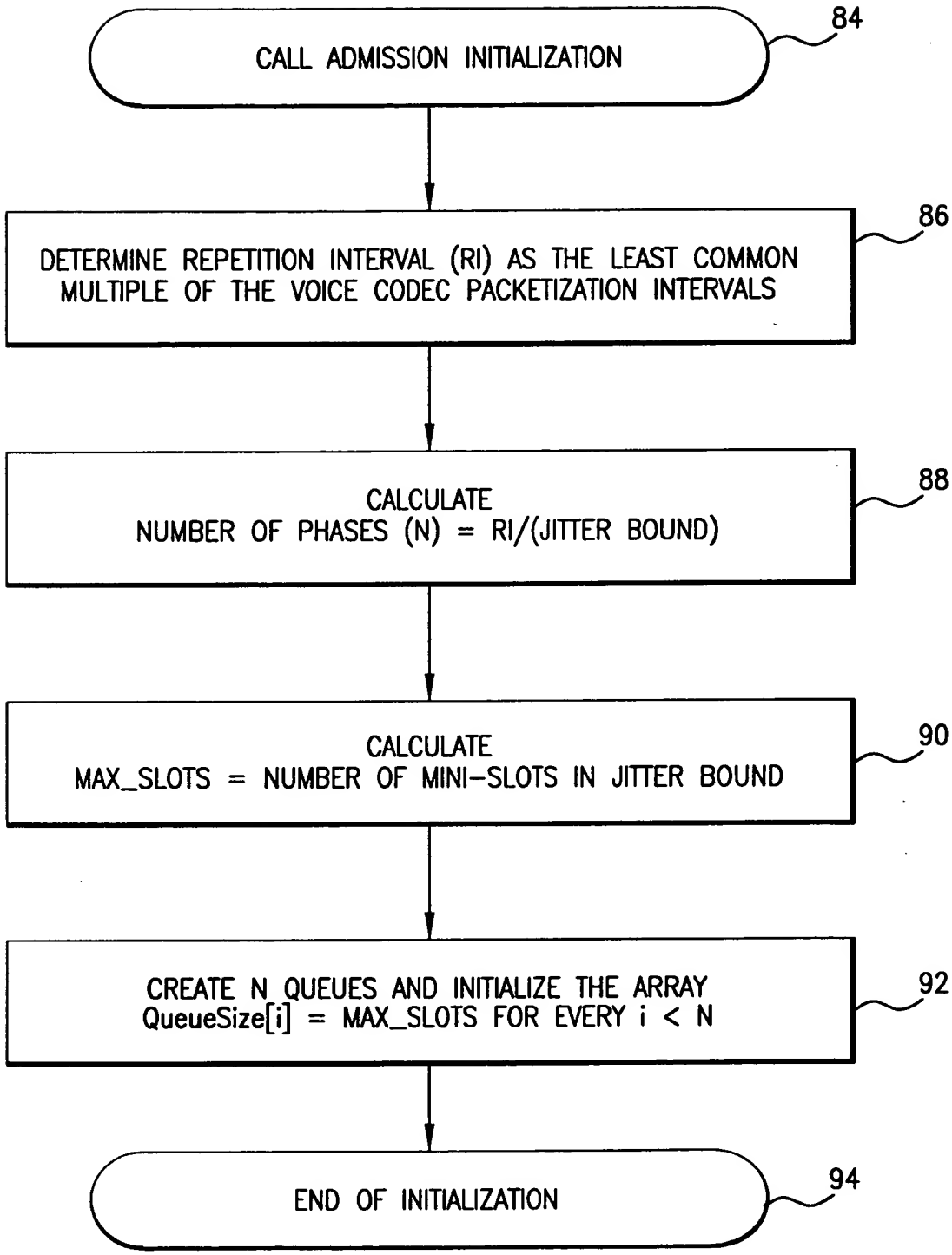

CALL ADMISSION INITIALIZATION
84
DETERMINE REPETITION INTERVAL (RI) AS THE LEAST COMMON MULTIPLE OF THE VOICE CODEC PACKETIZATION INTERVALS
86
CALCULATE
NUMBER OF PHASES (N) = RI/(JITTER BOUND)
88
CALCULATE
MAX_SLOTS = NUMBER OF MINI-SLOTS IN JITTER BOUND
90
CREATE N QUEUES AND INITIALIZE THE ARRAY
QueueSize[i] = MAX_SLOTS FOR EVERY i < N
92
END OF INITIALIZATION
94

FIG.7

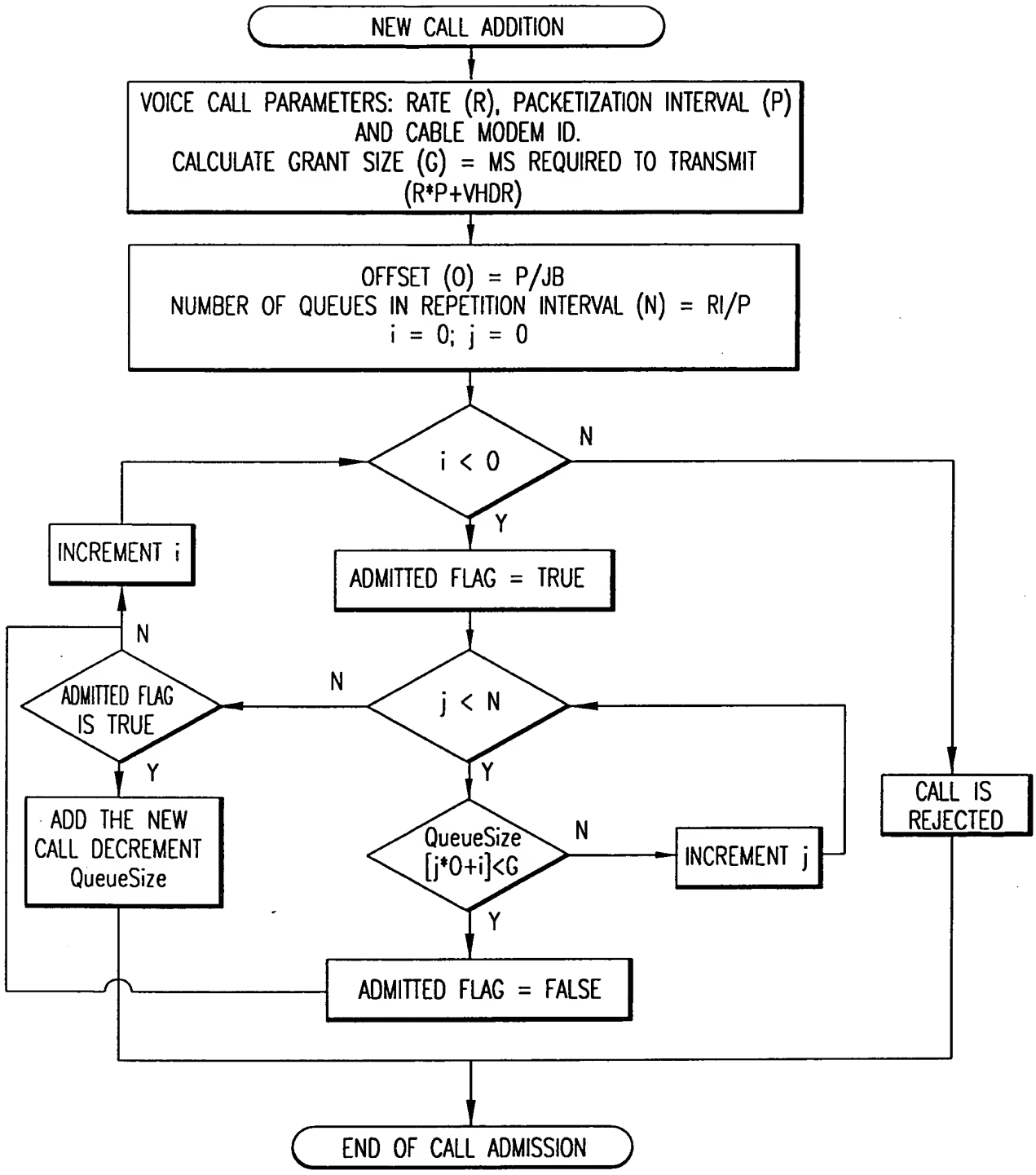

NEW CALL ADDITION
VOICE CALL PARAMETERS: RATE (R), PACKETIZATION INTERVAL (P) AND CABLE MODEM ID.
CALCULATE GRANT SIZE (G) = MS REQUIRED TO TRANSMIT (R*P+VHDR)
OFFSET (O) = P/JB
NUMBER OF QUEUES IN REPETITION INTERVAL (N) = RI/P
i = 0; j = 0
i < 0
N
Y
INCREMENT i
ADMITTED FLAG = TRUE
N
ADMITTED FLAG IS TRUE
N
j < N
Y
Y
ADD THE NEW CALL DECREMENT QueueSize
QueueSize [j*O+i]<G
N
INCREMENT j
Y
CALL IS REJECTED
ADMITTED FLAG = FALSE
END OF CALL ADMISSION

FIG.8

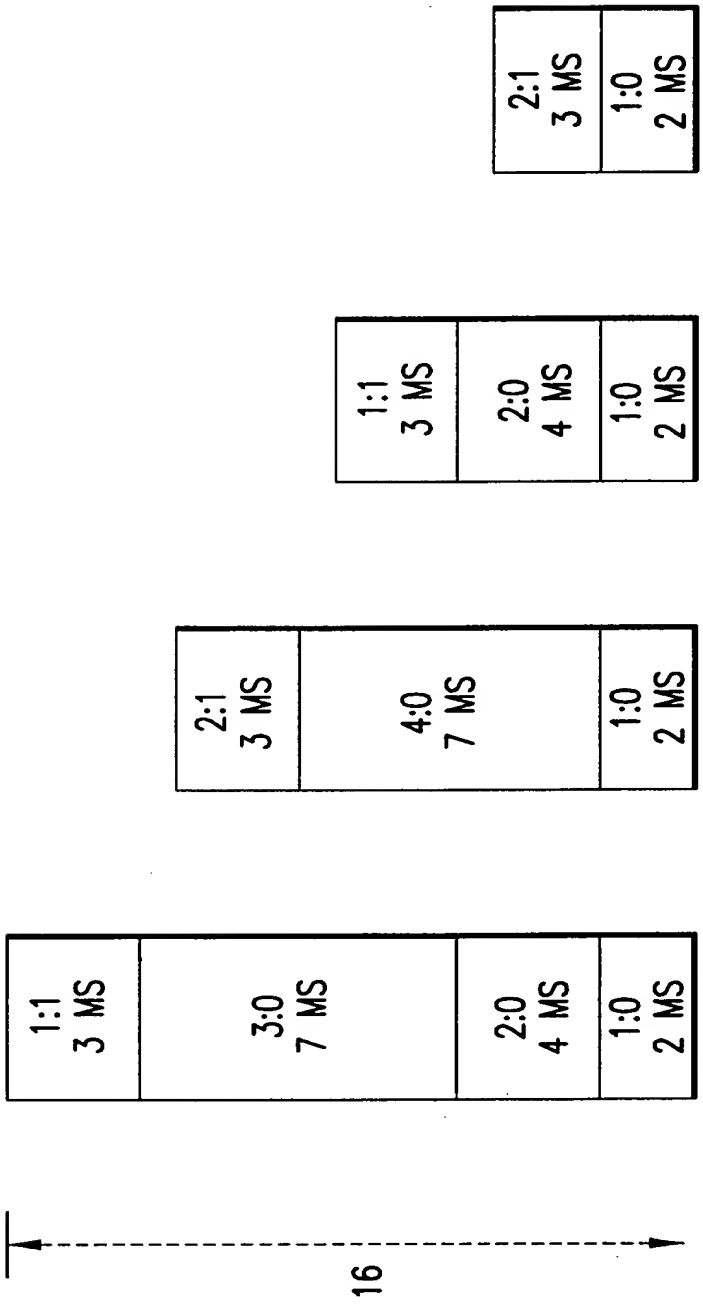
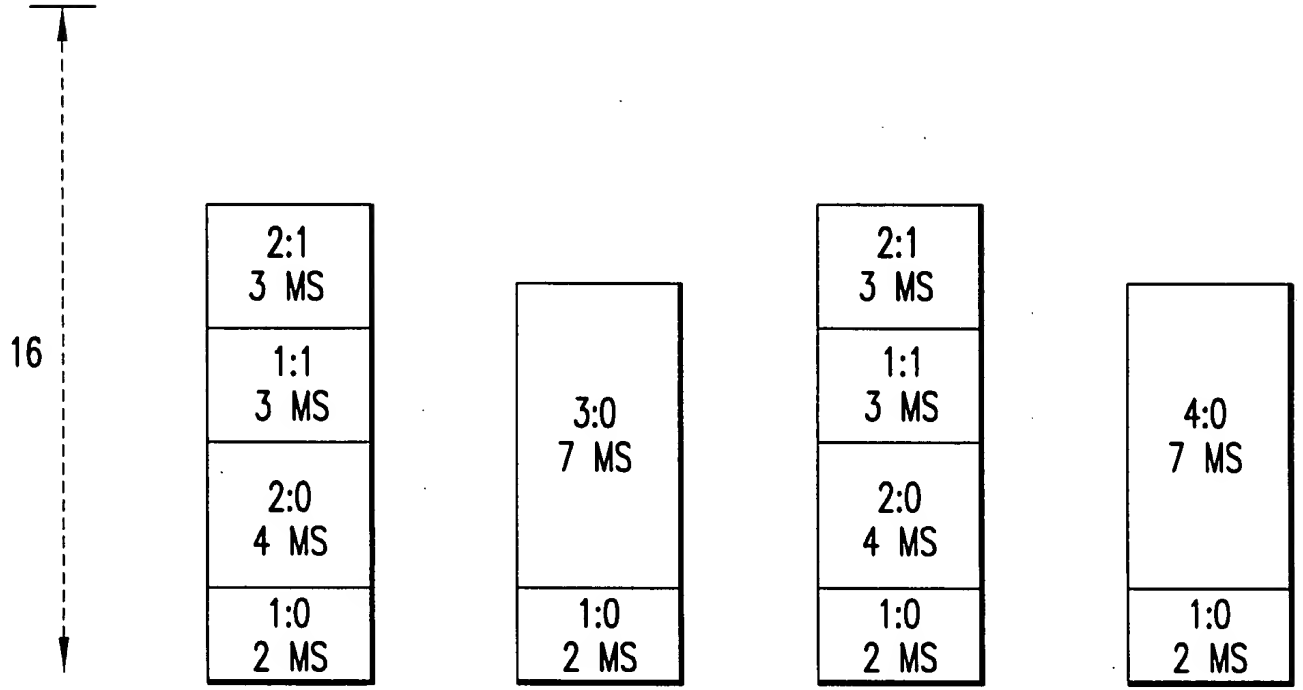
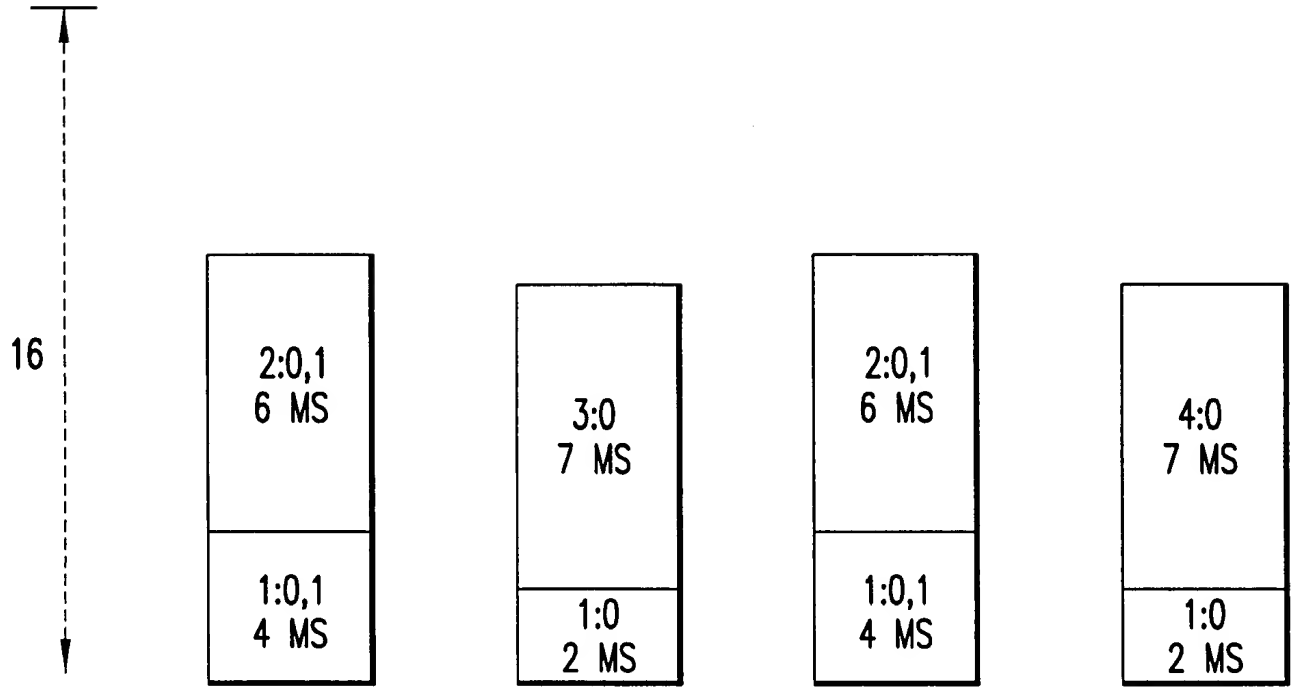

1:1
3 MS
3:0
7 MS
2:0
4 MS
1:0
2 MS
16
2:1
3 MS
4:0
7 MS
1:0
2 MS
1:1
3 MS
2:0
4 MS
1:0
2 MS
2:1
3 MS
1:0
2 MS
CALL ADMISSION: UNBALANCED

FIG.9



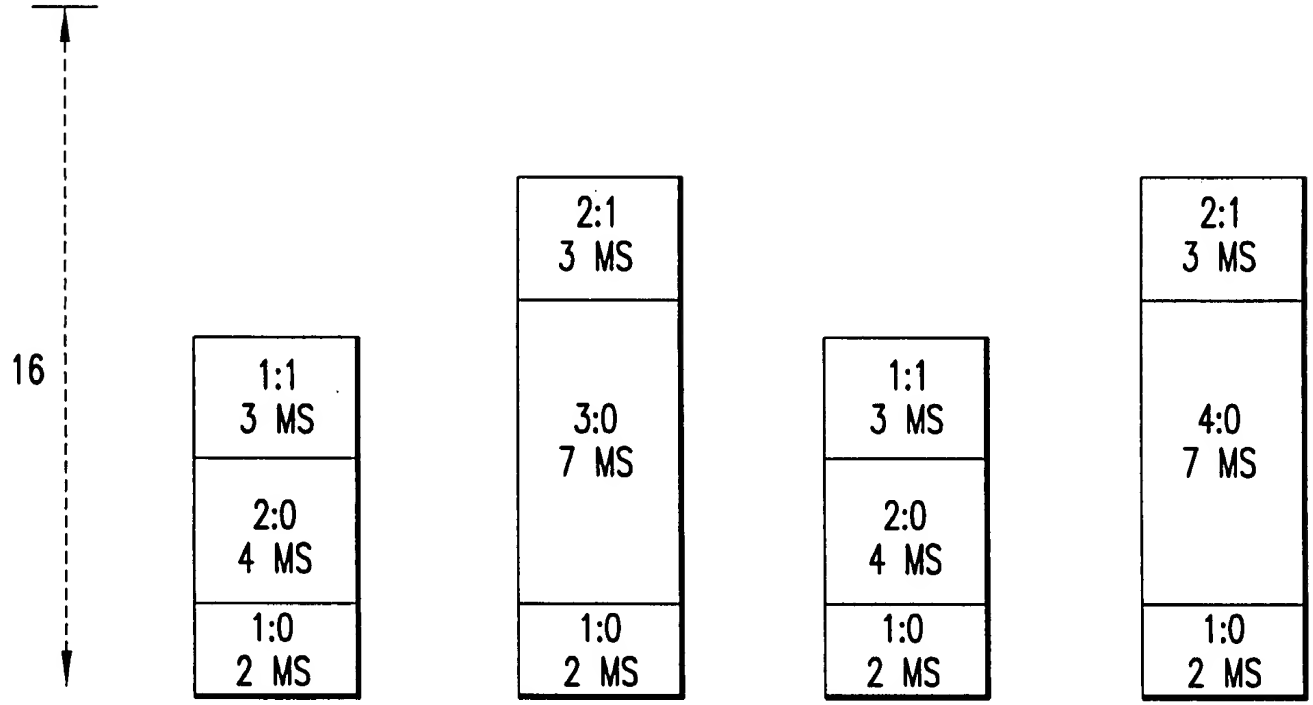
CALL ADMISSION: BALANCED

FIG.10



CALL ADMISSION: BALANCED WITH CONCATENATION

FIG.11



CALL ADMISSION: BALANCED AND DISTRIBUTED CM ALLOCATION

FIG.12

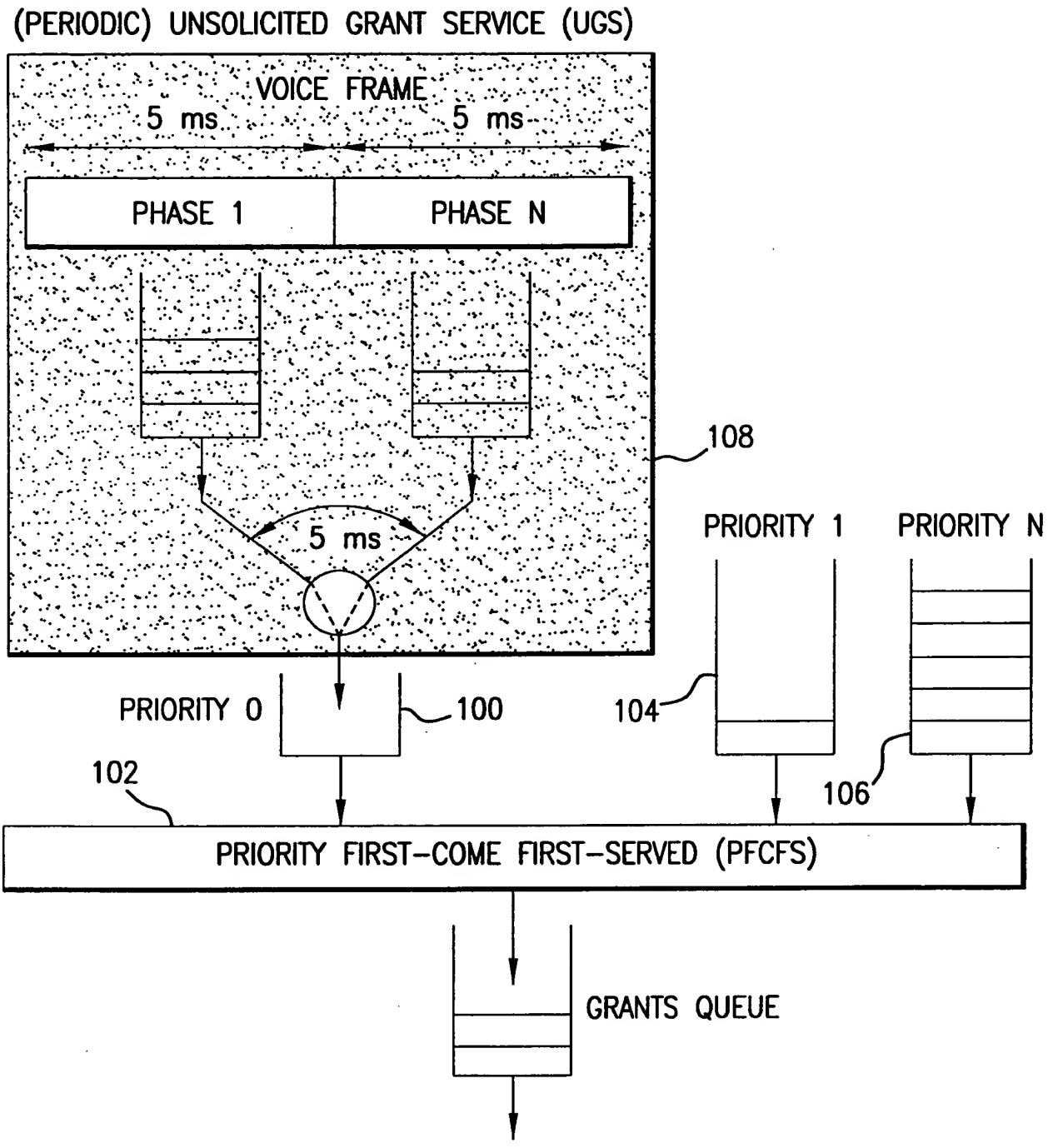

(PERIODIC) UNSOLICITED GRANT SERVICE (UGS)
VOICE FRAME
5 ms
5 ms
PHASE 1
PHASE N
5 ms
108
PRIORITY 1
PRIORITY N
PRIORITY 0
100
104
102
106
PRIORITY FIRST-COME FIRST-SERVED (PFCFS)
GRANTS QUEUE

FIG.13

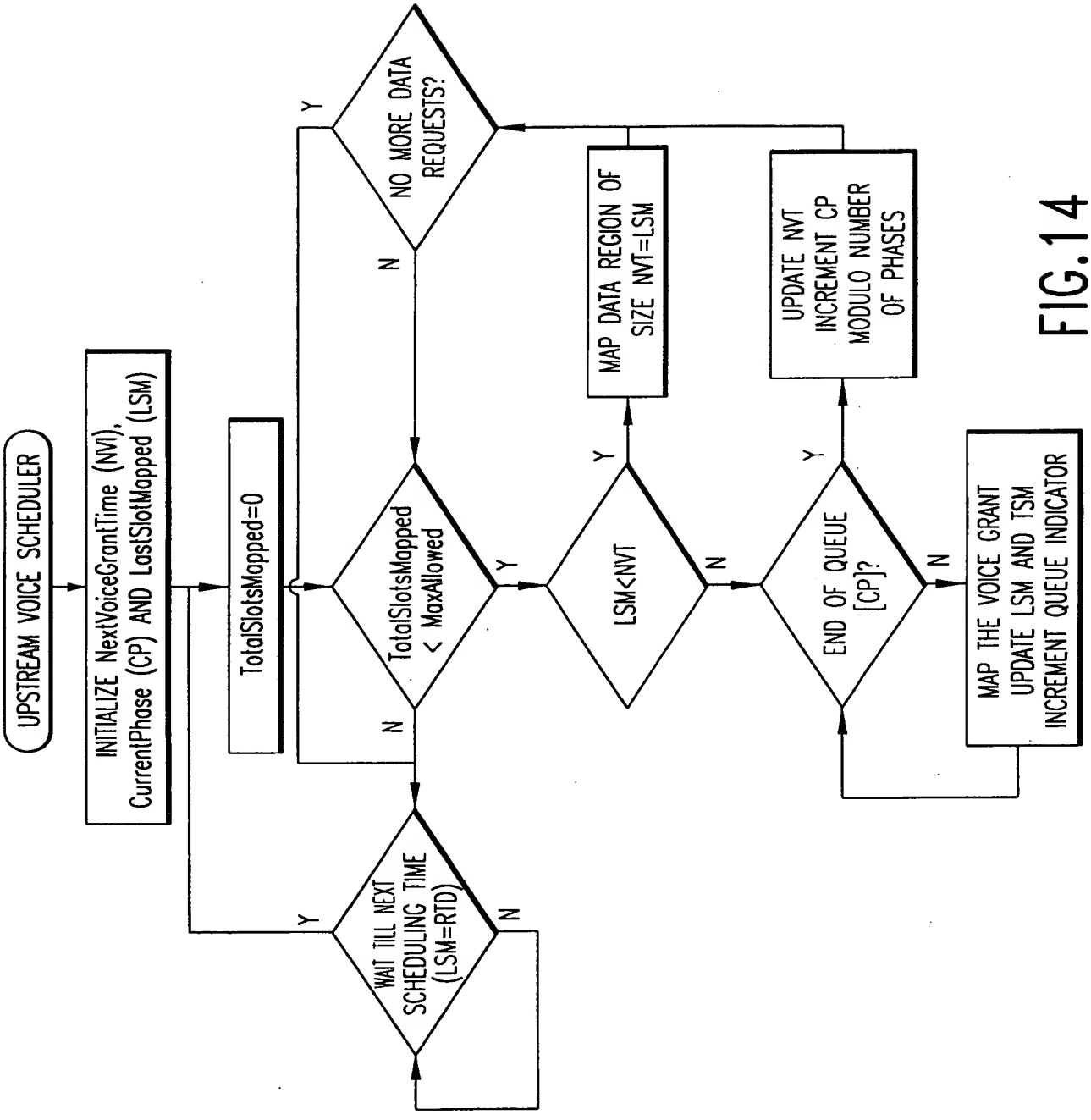

UPSTREAM VOICE SCHEDULER
INITIALIZE NextVoiceGrantTime (NVI), CurrentPhase (CP) AND LastSlotMapped (LSM)
TotalSlotsMapped=0
WAIT TILL NEXT SCHEDULING TIME (LSM=RTD)
TotalSlotsMapped < MaxAllowed
NO MORE DATA REQUESTS?
LSM<NVT
MAP DATA REGION OF SIZE NVT=LSM
END OF QUEUE [CP]?
UPDATE NVT INCREMENT CP MODULO NUMBER OF PHASES
MAP THE VOICE GRANT UPDATE LSM AND TSM INCREMENT QUEUE INDICATOR
Y
N

FIG.14

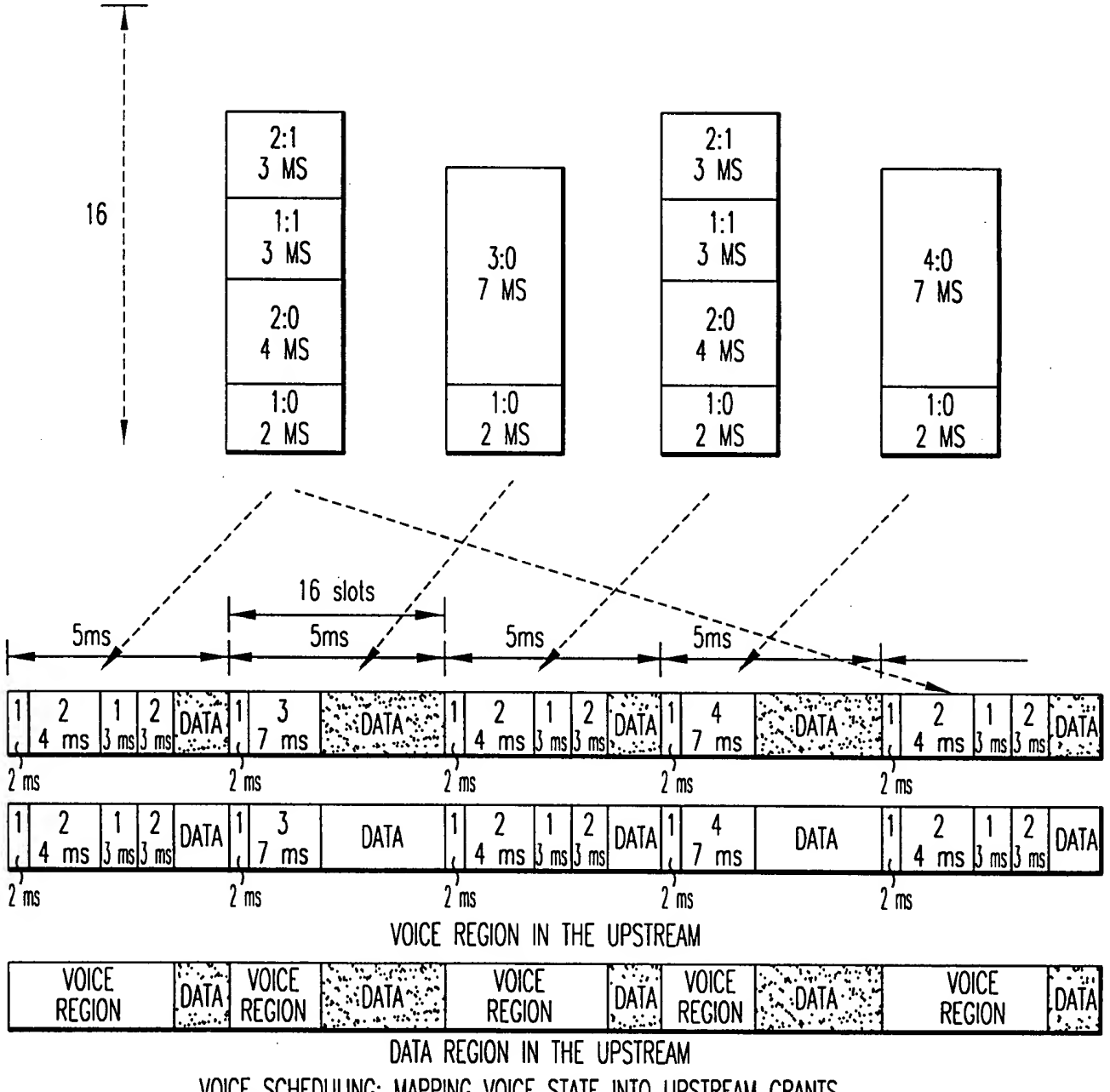


FIG.15

VOICE SCHEDULING: MAPPING VOICE STATE INTO UPSTREAM GRANTS

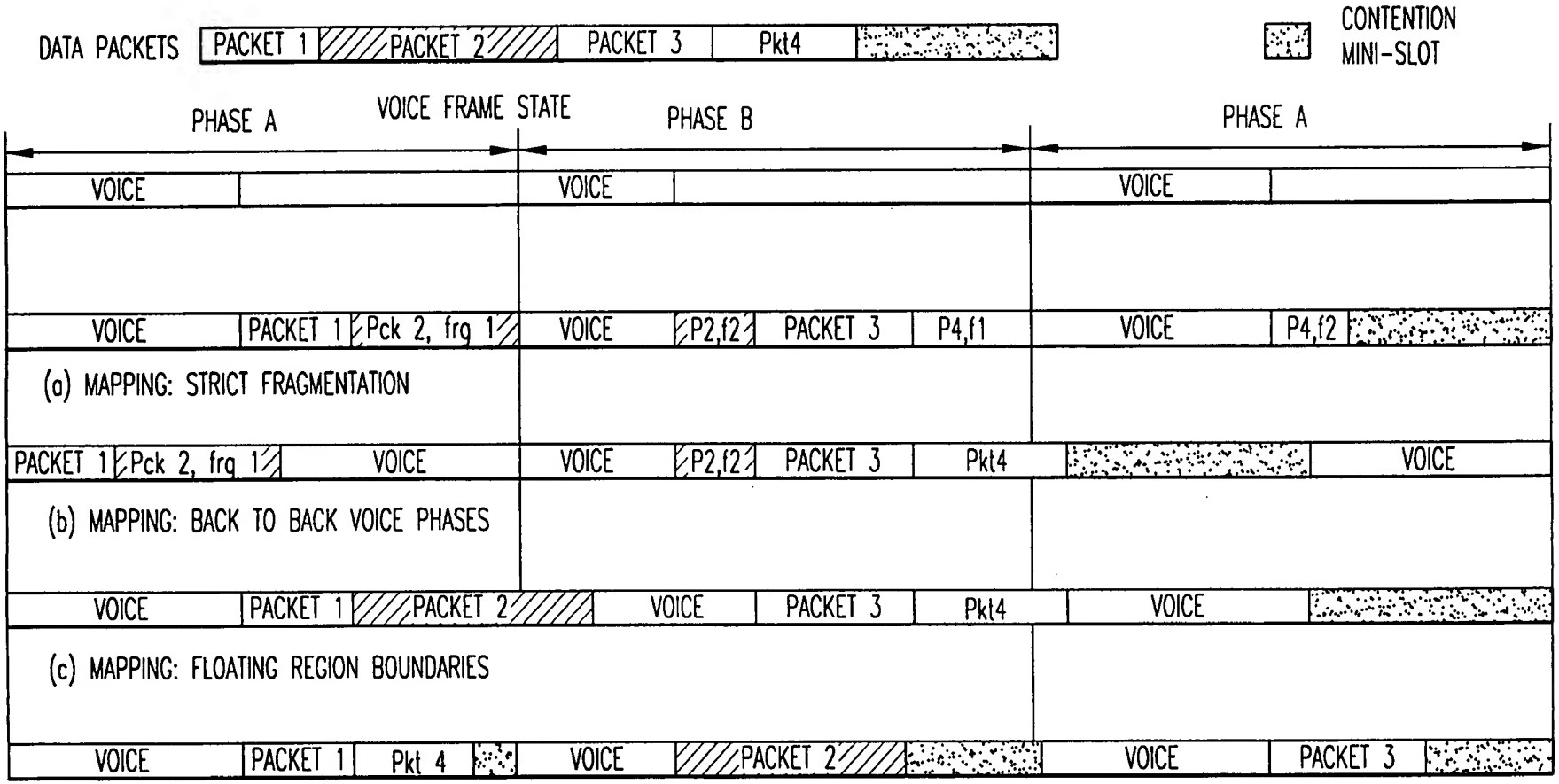

DATA PACKETS
PACKET 1
PACKET 2
PACKET 3
Pkt4
CONTENTION MINI-SLOT
PHASE A
VOICE FRAME STATE
PHASE B
PHASE A
VOICE
VOICE
VOICE
VOICE
PACKET 1
Pck 2, frg 1
VOICE
P2,f2
PACKET 3
P4,f1
VOICE
P4,f2
(a) MAPPING: STRICT FRAGMENTATION
PACKET 1
Pck 2, frg 1
VOICE
VOICE
P2,f2
PACKET 3
Pkt4
VOICE
(b) MAPPING: BACK TO BACK VOICE PHASES
VOICE
PACKET 1
PACKET 2
VOICE
PACKET 3
Pkt4
VOICE
(c) MAPPING: FLOATING REGION BOUNDARIES
VOICE
PACKET 1
Pkt 4
VOICE
PACKET 2
VOICE
PACKET 3
(d) MAPPING: FIXED REGION BOUNDARIES: BEST FIT (NO FRAGMENTATION)

FIG.16

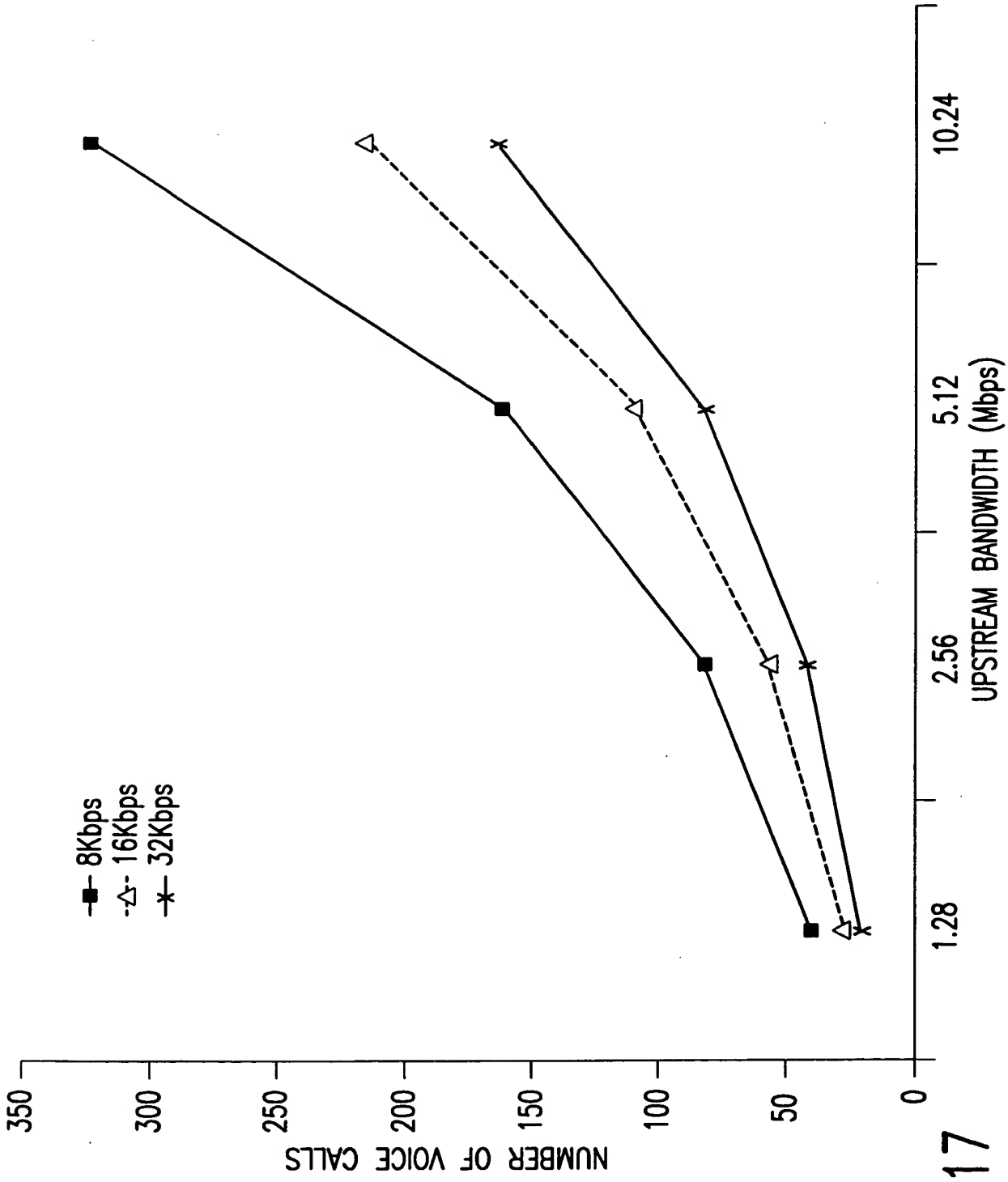

NUMBER OF VOICE CALLS
350
300
250
200
150
100
50
0
1.28
2.56
5.12
10.24
UPSTREAM BANDWIDTH (Mbps)
8Kbps
16Kbps
32Kbps

FIG.17

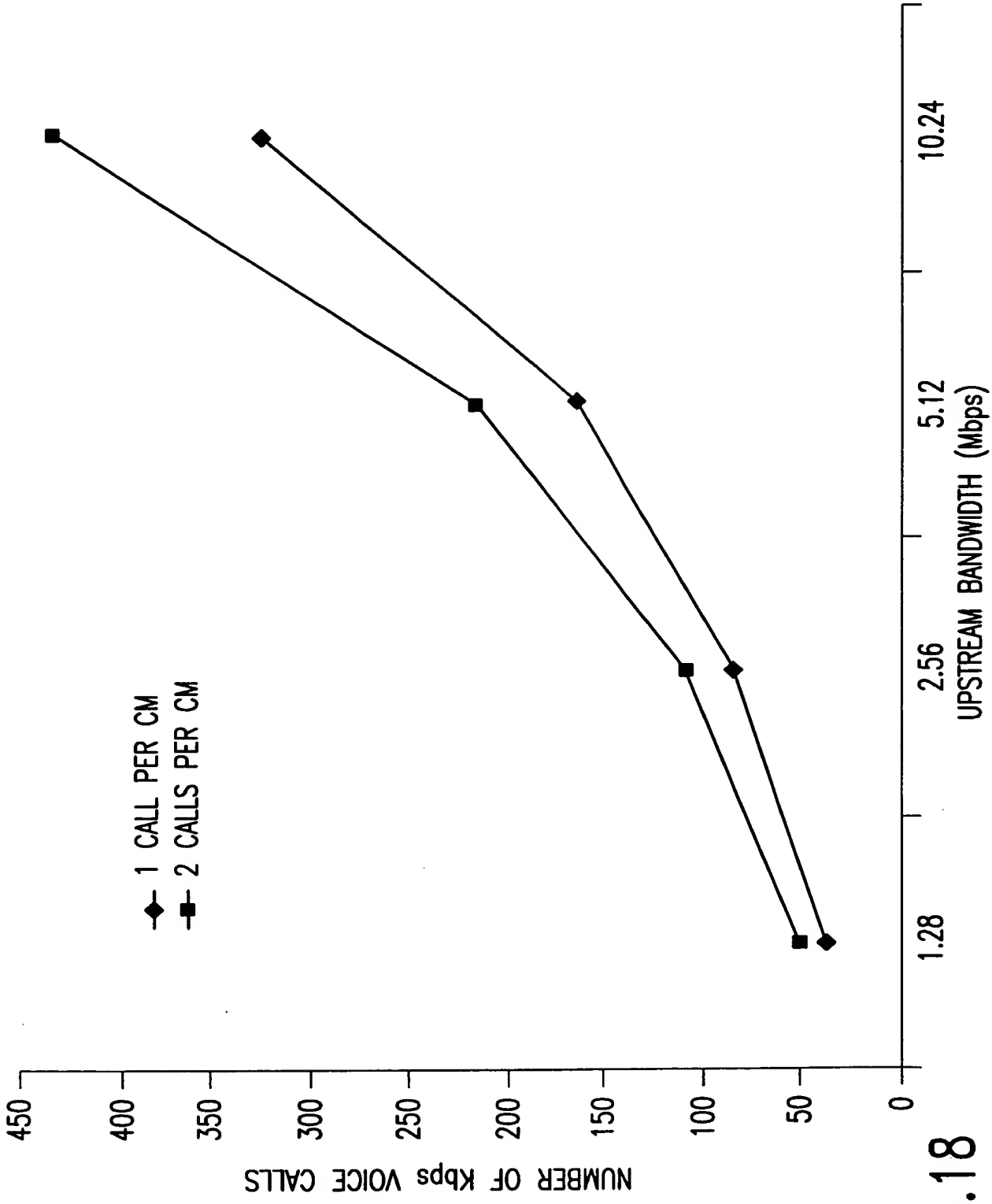

NUMBER OF kbps VOICE CALLS
450
400
350
300
250
200
150
100
50
0
1 CALL PER CM
2 CALLS PER CM
1.28
2.56
5.12
10.24
UPSTREAM BANDWIDTH (Mbps)

FIG.18

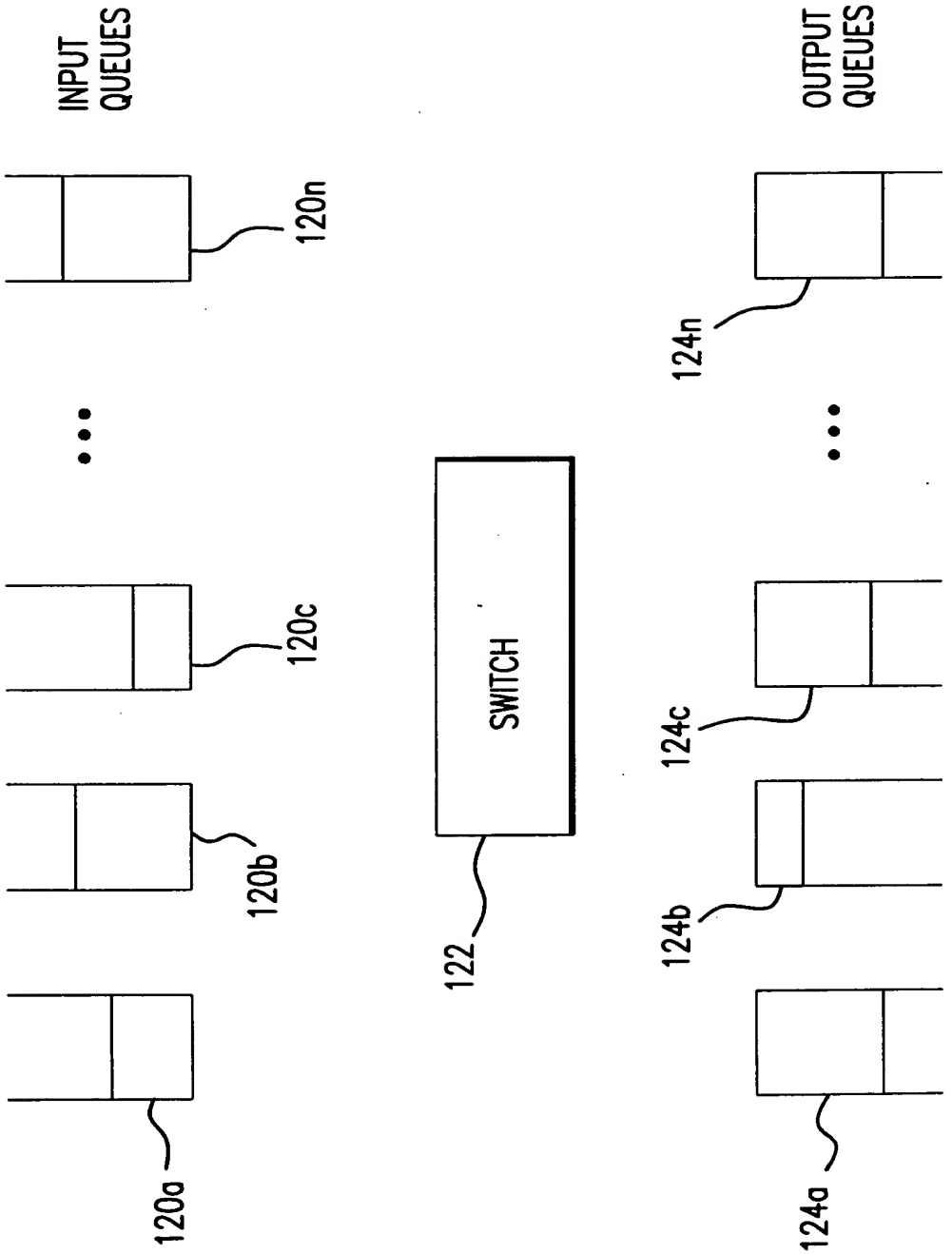

INPUT QUEUES
120n
120c
120b
120a
SWITCH
122
OUTPUT QUEUES
124n
124c
124b
124a

FIG.19